ELEC-204 HW-3

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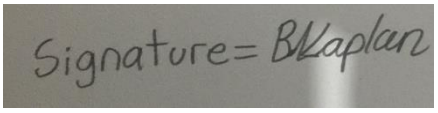

SOLUTIONS OF THE PROBLEMS

1-)

a-) X= A+B+C

A	B	C	X
1	1	1	1
1	1	0	1
1	0	1	1
0	1	1	1
0	0	0	0
0	1	0	1
0	0	1	1
1	0	0	1

b-) X= (A+B)*C

A	B	C	A+B	(A+B)*C
0	0	0	0	0
0	0	1	0	0
0	1	0	1	0
0	1	1	1	1
1	0	0	1	0
1	1	0	1	0
1	0	1	1	1
1	1	1	1	1

3-) (A+B)*(B+C)'

A	B	C	A+B	B+C	(B+C)'	(A+B)*(B+C)'
0	0	0	0	0	1	0
0	0	1	0	1	0	0
0	1	0	1	1	0	0
0	1	1	1	1	0	0
1	0	0	1	0	1	1
1	0	1	1	1	0	0
1	1	0	1	1	0	0
1	1	1	1	1	0	0

2-) (A*B'*(C+B*D)+A'*B')*C

= ((A*B'*C+A*B*D*B')+A'*B')*C (After the distribution, we get this expression.)

(B*B')=0 (One of the rules in the boolean algebra.)

=((A*B'*C+0)+A'*B')*C (After simplification and after we put 0 instead of B*B')

C*C = C (One of the rules in the boolean algebra.)

=A*B'*C*C+A'*B'*C= (A*B'*C)+(A'*B'*C), (After the distribution and after we put C instead of C*C, we get this expression.)

= B'*C*(A+A')

(A+A')=1(One of the rules in boolean algebra.)

(B')*(C)*(1)= (B')*(C) (Since A+A'=1, the above expression becomes (B')*(C))

When we simplify the initially given expression in the question, we get (B')*(C).

So, the answer is (B')*(C).

3-)

a-)

w	x	y	z	w'	y'	w'*x*y	w'*y*z	w*y'*z	w'*y'*z	x*y	w'*x*y+w'*y*z+w*y'*z+w'*y'*z+x*y
0	0	0	0	1	1	0	0	0	0	0	0
0	0	0	1	1	1	0	0	0	1	0	1
0	0	1	0	1	0	0	0	0	0	0	0
0	1	0	0	1	1	0	0	0	0	0	0
1	0	0	0	0	1	0	0	0	0	0	0
1	1	0	0	0	1	0	0	0	0	0	0
1	1	1	0	0	0	0	0	0	0	1	1
1	1	1	1	0	0	0	0	0	0	1	1
1	1	0	1	0	1	0	0	1	0	0	1
1	0	1	1	0	0	0	0	0	0	0	0
0	1	1	1	1	0	1	1	0	0	1	1
0	0	1	1	1	0	0	1	0	0	0	1
0	1	1	0	1	0	1	0	0	0	1	1
0	1	0	1	1	1	0	0	0	1	0	1
1	0	0	1	0	1	0	0	1	0	0	1
1	0	1	0	0	0	0	0	0	0	0	0

c-) F= w'*x*y+w'*y*z+w*y'*z+w'*y'*z+x*y

F= y'*z*(w+w')+x*y+w'*y*(x+z)

(w)+(w')=1 (One of the rules in boolean algebra)

F= y'*z*1+x*y+w'*y*(x+z)

F= y'*z+x*y+x*y*w'+y*z*w'

F= x*y*(1+w')+y'*z+y*z*w'

(1+w')=(1) (One of the rules in boolean algebra)

F= x*y*1+y'*z+w'*y*z

F=x*y+y'*z+w'*y*z (The simplified version of F function)

d-) The truth table for the function F, where F is x*y+y'*z+w'*y*z.

w	x	y	z	w'	y'	y'*z	w'*y*z	x*y+y'*z+w'*y*z
0	0	0	0	1	1	0	0	0
0	0	0	1	1	1	1	0	1
0	0	1	1	1	0	0	1	1
0	0	1	0	1	0	0	0	0
0	1	0	0	1	1	0	0	0
0	1	0	1	1	1	1	0	1
0	1	1	0	1	0	0	0	1
0	1	1	1	1	0	0	1	1
1	0	0	0	0	1	0	0	0
1	0	0	1	0	1	1	0	1
1	0	1	0	0	0	0	0	0
1	0	1	1	0	0	0	0	0
1	1	0	1	0	1	1	0	1
1	1	0	0	0	1	0	0	0
1	1	1	1	0	0	0	0	1
1	1	1	0	0	0	0	0	1

When we compare the output values of the simplified version of F and the long version of F for identical input values, we can observe that the output values are same for the simplified version of F and the long version of F. What I mean by input values here is the w,x,y,and z values. Since the output values are same for same input values, the truth tables for the simplified version of F and for the long version of F are same.

e-)

<u>TOTAL NUMBER OF GATES FOR THE ORIGINAL BOOLEAN EXPRESSION</u>

In the long and original version of the F, there are 5 main inputs which are connected with OR symbol. This means that we need 1 OR gate which includes 5 inputs. When we examine the inputs individually, we can observe that there are 4 inputs each of which includes 3 sub-inputs.

These 3 sub-inputs are connected with AND symbol. So, we need 4 AND gates each of which includes 3 sub-inputs. In the expression, there is also one input which includes 2 sub-inputs. These 2 sub-inputs are connected with AND symbol. So, we need 1 AND gate which includes 2 sub-inputs. In total, we need 6 gates for the original version of F. (4+1+1=6)

TOTAL NUMBER OF GATES FOR THE SIMPLIFIED BOOLEAN EXPRESSION

In the simplified version of F, there are 3 main inputs which are connected with OR symbol. So, we need 1 OR gate which includes 3 inputs. When we examine the inputs individually, we can see that there are 2 inputs each of which contains 2 sub-inputs, and there is 1 input which contains 3 sub-inputs. These sub-inputs are connected with AND symbol. So, we need 2 AND gates each of which includes 2 sub-inputs. Moreover, we need 1 AND gate which contains 3 sub-inputs. In total, we need 4 gates for the simplified version of F. (2+1+1=4)

So, we need more gates for the original version of F. (6>4)

For part-b and part-e in the third question, I attached a seperate image in the submission.